Addendum to LSOP A-05-006-LSOP

This is an addendum to the LSOP A-05-006-LSOP, dated 9/9/05, for the ITS Laser Room, Building No. 58, Rm. 129C. This addendum is for the inclusion of a second Class 4 Nd:YVO4 laser system with power output up to 11 Watts, in addition to a similar one already described in the LSOP with power output up to 5 Watts. All of the precautions covered in the LSOP apply to the additional laser as well with the exception that the required OD for eyewear at 532 nm is now 4.05. To reinforce this notable difference **only eyewear of OD > 4.05 may be worn in the laser room when either Nd:YVO4 laser system (5 W or 11 W) is used**.

Once this addendum is approved all laser room users must read, sign and date before working in the laser room when the laser interlock is energized.

Name	Signature	Date

Class 4 Nd:YVO4 Laser System

The green light from the Coherent Verdi V-10 frequency-doubled Nd:YVO4 laser is powerful and may burn skin and damage eyes through direct illumination or specular reflection. Laser eyewear with OD > 4.05 for 532 nm must be worn.

Description

Type of Laser	Frequency-doubled Nd:YVO4
Manufacturer	Coherent (commercial high power laser)
Model Number	Verdi V-10
Serial Numbers	V10-A0436, V10-A0024
Wavelength	532 nm (visible - green)
Power Range	Up to 11 W, 100 mW typical.
Mode (i.e., time structure)	DC.
Beam Diameter (collimated, typical)	2.25 mm at output coupler
Divergence (uncollimated, typical)	0.35 mrad +/- 10%

Manual and data sheet are maintained in Bldg 90 room 118.

MPE Calculation Results (see included Laser Hazard Analysis)

Laser	MPE/eye mW/cm^2	Nominal Hazard Zone meters	Required OD for eyewear
Nd:YVO4 532 nm	2.55	3000	4.05

September 23, 2004

Laser Hazard Analysis

Nd:YVO4 at 0.5320 μm

ANSI Z-136.1 (2000)

Location:
Building: Rm:
Reference: **ITS South Cave** Class: **IV**

Mode: **Continuous Wave**		Average Power:	**1.10E+01** Watts	Beam Size on Diffuser:	mm
Shape: **Circular**		Exposure Time:	**2.50E-01** Seconds	Diffuser-Observer Distance:	Meters
				Viewing Angle off Normal:	Degrees
Major Axis Dimension:	**2.25** mm	Pulse Energy:	Joules	Reflection Coefficient:	Percent
Major Axis Divergence:	**0.35** mrad	Pulse Length:	Seconds		
		Pulse Rate:	Hertz	Fiber Optics Mode:	**None**
Minor Axis Dimension:	mm	Pulse Time Envelope:	Seconds	Min. Beam Waist:	μm
Minor Axis Divergence:	mrad			Numerical Aperture:	
		Lens Focal Length:	mm		
Gaussian Criteria:	**e-2**	Beam Size at Lens:	mm	Small Source Range:	Meters

Maximum Permissible Exposure (MPE)		**Small Source Intrabeam Viewing at Known Range**	
Small Source MPE (Eye)	**2.55E-03 W/cm²**	Beam Area	**N/A**
Extended Source MPE (Eye)	**N/A**	Calculated exposure	**N/A**
Small Area MPE (Skin)	**3.11E+00 W/cm²**	Minimum required optical density	**N/A**
Small Source Intrabeam Viewing		**Nominal Hazard Zones**	
Average power	**1.10E+01 Watts**	Small source diffuse reflections	**N/A**
Energy per pulse	**N/A**		
Pulse peak power	**N/A**	Lens on laser condition	**N/A**
Time	**2.50E-01 Seconds**	Intrabeam exposure condition	**3.00E+03 Meters**
Limiting aperture (Eye)	**7.00E+00 mm**	Multi-mode fiber optics	**N/A**
Limiting aperture (Skin)	**3.50E+00 mm**	Single mode fiber optics	**N/A**
Irradiance at eye	**2.86E+01 W/cm²**		
Radiant exposure at eye	**N/A**	**Ocular Exposure to Diffuse Laser Radiation**	
Minimum required optical density	**4.05**	Source type	**N/A**
Filter transmittance	**8.91E-05**	Actual viewing angle (alpha)	**N/A**
		Limiting viewing angle (alpha-min)	**N/A**
Small Source Diffuse Viewing		Maximum large source range	**N/A**
Average power	**N/A**	Required minimum optical density	**N/A**
Energy per pulse	**N/A**	Calculated exposure	**N/A**
Minimum range	**N/A**		
	N/A	**Calculated Correction Factors**	
Radiant exposure at eye	**N/A**	Thermal/photochemical factor: T1	**N/A**
Power at eye	**N/A**	Near-infrared correction factor: CA	**N/A**
Energy at eye	**N/A**	Visible wavelengths correction factor: CB	**43.65**
Minimum required optical density	**N/A**	Special near-infrared correction factor: CC	**N/A**
Filter transmittance	**N/A**	Extended source correction factor: CE	**N/A**
		Total pulses	**N/A**
Small Source Multiple Pulse Factors		Extended source effective total pulses:	**N/A**
Small source effective total pulses:	**N/A**	Multiple pulse correction factor: Cp (Extended)	**N/A**
Multiple Pulse Correction Factor: Cp	**N/A**	UV eye or skin exposure over 2 days	**N/A**
MPE rule applied:	**N/A**		

Comments